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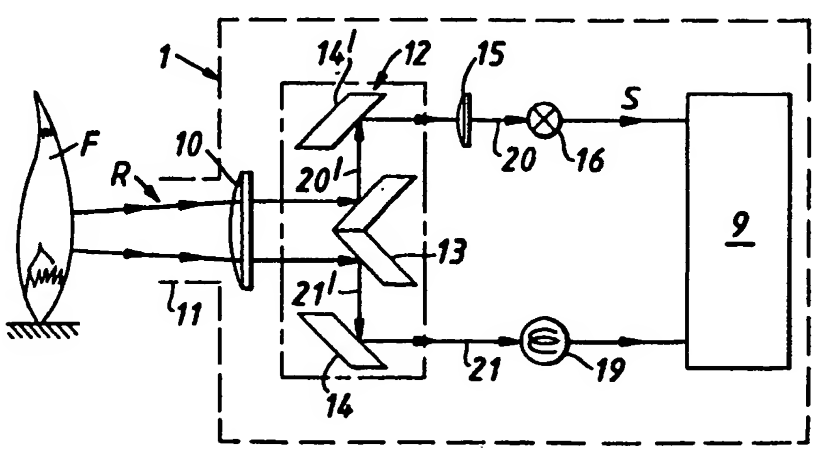
(54) Flame condition monitoring

(57) A device for monitoring the condition of a flame has a beam splitter 13 which splits a beam of electromagnetic radiation emanating from a flame (F) into two separate beams 20 and 21 with the same bandwidth. An infra-red detector 16 senses the IR components of one beam 21 while an ultra-violet detector 19 senses the UV components of the other beam 20. The detectors may provide a processor 9 with an analogue signal representing the flicker frequency of the IR component and a digital signal representing the total energy in the UV component.

FIG. 1.



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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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FIG.1.

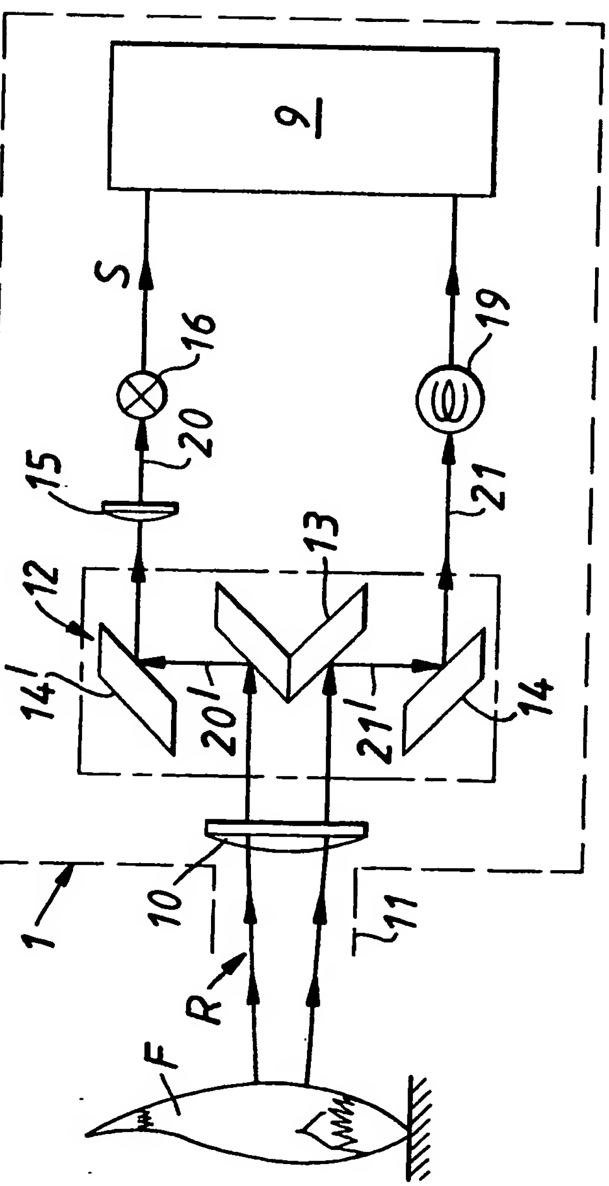

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FIG. 2.

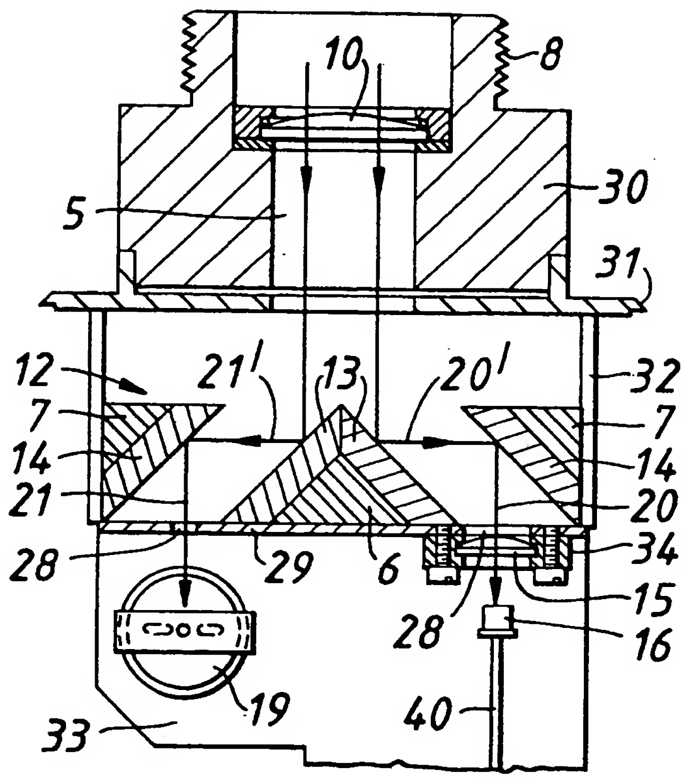
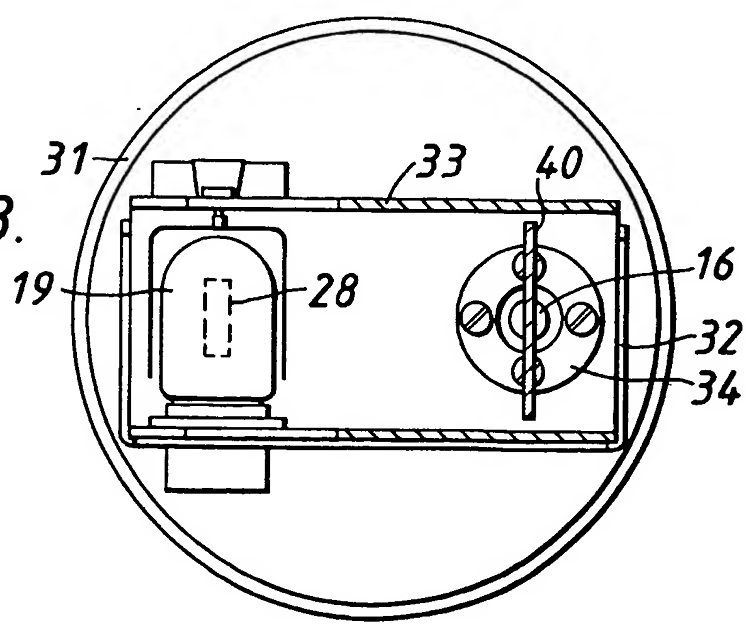


FIG. 3.



SPECIFICATION

Flam conditi n monitoring

The present invention relates to general flame condition monitoring.

In order to monitor the condition of a flame, say in a multi-fuel burner, it has been known to use an ultra-violet detector or an infra-red detector both of which have advantages in certain applications. The infra-red detector serves to detect the so-called flicker frequency of the flame and uses this to ascertain the condition of the flame. The ultra-violet detector in contrast detects the total energy of the ultra-violet component of the flame. Prior art attempts to combine the use of ultra-violet and infra-red detectors have not been wholly successful.

A general object of the present invention is to provide an improved device for, and method of, monitoring a flame.

A device constructed in accordance with the invention has means for providing a beam of electromagnetic radiation energy emanating from a flame, means for splitting said beam into two further beams with the same bandwidth one of which is detected by ultra-violet sensing means and the other of which is detected by infra-red sensing means. By splitting the energy beam emanating from the flame into the two beams and analysing these beams separately for ultra-violet and infra-red characteristics, the disadvantages of known combined sensing devices are overcome. The signals produced by the infra-red and ultra-violet sensing means can be processed separately or combined according to need.

The invention also provides a method of monitoring the condition of a flame; said method comprising producing a beam of electromagnetic radiation energy emanating from the flame to be monitored, splitting said beam into two further separate beams with the same bandwidth, detecting ultra-violet (u.v) components of one of the further beams with an ultra-violet detector and detecting infra-red components (i.r.) of the other of the further beams with an infra-red detector.

The invention may be understood more readily, and various other aspects and features of the invention may become apparent from consideration of the following description.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a sch matic r presentation of a device constructed in accordance with the invention;

Figure 2 is a part sectional side view of a practical form of th device; and

Figure 3 is an inverted plan view of the device shown in Fig. 2 and partly in section.

As shown in Fig. 1 a device 1 constructed in accordance with the invention has a primary l ns 10 which serves to collimate lectromagnetic radiation R, including light, r c ived from a flame F and entering a sighting tube 11. Instead of the lens 10, a radiation transparent window can be used. The beam emanating from the lens 10 or window enters a mirror/prism assembly 12 and impinges on a beam splitter 13 of the assembly. The beam splitter 13 may be composed of angularly off-set reflecting means such as mirrors or a prism arranged so as to form two beams 20′, 21′ which are redirected by means of further reflecting means 14, 14′ or mirrors as beams 20, 21 along two separate parallel paths or channels. The wavelength of the band of frequencies in the beams 20, 21 is the same. One beam 20 passes through an infra-red secondary focusing lens 15 and is collected by an infra-red detector 16. The other beam 21 is collected by an ultra-violet detector 19 which has an in-built focussing lens. The detector 16 is a photovoltaic diode and the detector 19 is a photoemissive vacuum phototube. Thus, the detectors 16, 19 are inherently sensitive to different wavebands and provide signals dependent on the energy in these wavebands. The infra-red detector 16 is typically responsive to a band with wavelengths in the range 200–800 nanometers whereas the u.v. detector 19 is typically responsive to a band with wavelengths in the range 150–250 nanometers. The output from the respective detectors 16, 19 denoted S and T are amplified and processed by a processor 9 and utilized to drive other equipment (not shown).

During use of the device, the flame F is monitored. The infra-red detector 16 serves to detect the 'flicker frequency' of the flame F as is known and signifies the condition of the flame as an analogue signal. Simultaneously the ultra-violet detector 19 senses the total energy of the ultra-violet component of the received radiation and inherently provides a digital signal.

Figs. 2 and 3 depict a practical form of the device where like reference numerals are used to denote like components and parts to Fig. 1. As shown, the lens 10 is supported by an O-ring within an end-block 30 having a stepped bore 5. The block 30 has an external screw-thread 8 which receives the sighting tube 11 (not shown in Fig. 2). A collar 31 generally surrounds the block 30 and fixes the latter to the assembly 12 which has a body 32 with blocks 7, 6 mounting four mirrors 13, 14 as shown. Th beams 20, 21 pass through apertures 28 in an end wall 29 of the assembly 12. In this mbodim nt the infra-red l ns 15 is carried by a mounting 34 on the end wall 29 in alignment with the aperture 28 passing th beam 20. The detectors 16, 19 ar supported on a chassis 33 fixed to th assembly 12 and a main casing (not shown)

encloses the components of the device.

In the case of the infra-red detector 16, the chassis 33 may also carry a printed-circuit board 40 with a pre-amplifier for the output signal and the processor 9 then includes a further amplifier for the infra-red signal(s).

The processor 9 may function in various ways. For example, the ultra-violet indicating signal T can be conditioned and converted into an equivalent analogue signal and the strongest signal S, T may then serve to activate some fail-safe mechanism or some visual indicator for display or means for controlling the fuel to the flame or an alarm or an ignition means. Alternatively, the signals S, T can be used independently from one another or combined after conversion and used to provide a composite flame condition signal which can be used in the various ways mentioned.

CLAIMS

1. A device for monitoring the condition of a flame; said device comprising means for deriving from the flame to be monitored a beam of electromagnetic radiation energy; means for splitting said beam into two further separate beams with the same bandwidth; a first sensing means for sensing ultra-violet components (u.v.) of one of the further beams and a second different sensing means for sensing the infra-red (i.r.) components of the other one of the further beams.

2. A device according to claim 1 and further comprising processing means for processing electrical signals provided by the first and second sensing means.

3. A device according to claim 2, wherein the first sensing means provides a digital signal representing the total energy of the sensed u.v. components and the second sensing means provides an analogue signal representing 'flicker' frequency.

4. A device according to claim 3, wherein the processing means converts the digital signal to a further analogue signal.

5. A device according to any one of claims 1 to 4, wherein the deriving means at least includes a sighting tube alignable with the flame and a lens or lenses for collimating radiation passed through the aperture to produce the beam.

6. A device according to any one of claims 1 to 4, wherein the splitting means comprises a prism or angularly offset reflectors.

7. A device substantially as described with ref renc to, and as illustrated in any on or more of the Figur s of the accompanying drawings.

8. A method of monitoring the condition of a flame; said m th d comprising producing a beam of electromagn tic energy emanating from th flame to be monitor d, splitting said beam into two further separate beams with the sam bandwidth, detecting ultra-violet (u.v.) components of one of the further beams with a ultra-violet detector and detecting infra-red compon nts (i.r.) of the other of th further beams with an infra-red detector.

9. A method according to claim 8, and further comprising providing electrical signals indicative of the detecting operations and processing the signals separately or as a combination.

10. A method of monitoring the condition of a flame substantially as described with reference to, and as illustrated in, the accompanying drawings.

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ABSTRACT:

A device for monitoring the condition of a flame has a beam splitter 13 which splits a beam of electromagnetic radiation emanating from a flame (F) into two separate beams 20 and 21 with the same bandwidth. An infra-red detector 16 senses the IR components of one beam 21 while an ultra-violet detector 19 senses the UV components of the other beam 20. The detectors may

provide a processor 9 with an analogue signal representing the flicker frequency of the IR component and a digital signal representing the total energy in the UV component. <IMAGE>